

Study of the elastic properties of $(\text{PbO})_x(\text{P}_2\text{O}_5)_{1-x}$ lead phosphate glass using an ultrasonic technique

ABSTRACT

Fabrication of a series of binary $(\text{PbO})_x(\text{P}_2\text{O}_5)_{1-x}$ lead phosphate glasses with various mole fractions ($x = 0.1$ to 0.6) was carried out using a conventional melt-quenching method. The glass density was measured by using Archimedes principle. The ultrasonic wave velocities (V_l and V_t) of the glasses were determined at room temperature by using a nondestructive test: the digital signal processing technique of the Ultrasonic Data Acquisition System (Matec 8020, Matec Instruments, USA). The experimental data for the wave velocities and densities were then used to determine the elastic properties in each series of lead phosphate glass systems: the longitudinal, shear, bulk and Young's moduli; Poisson's ratio; and the Debye temperature. Based on the results obtained, the longitudinal, shear, bulk and Young's moduli of the glasses increased with the addition of PbO content. The Poisson's ratio obtained remains almost constant, while the Debye temperature shows a continuous decrease with the addition of PbO content.

Keyword: Glasses; Ultrasonic measurement; Elastic properties.